Claims

[c1] 1. An emission control system for controlling NOx and NH_3 emissions from an exhaust stream, the system comprising:

a lean NOx trap in communication with the exhaust stream for reducing NOx emissions; and

a NH_3-SCR catalyst in communication with the exhaust stream for adsorbing NH_3, wherein the NH_3 adsorbed by the NH_3-SCR catalyst reacts with NOx in the exhaust stream to improve the reduction of NOx and NH_3.

[c2] 2. The emission control system of claim 1, wherein one or more alternating layers of the lean NOx trap and NH_3-SCR catalyst are provided in a single catalytic converter shell.

[c3] 3. The emission control system of claim 1, wherein one or more alternating layers of the lean NOx trap and NH_3-SCR catalyst are provided in a single substrate.

[c4] 4. The emission control system of claim 1, wherein one or more alternating zones of the lean NOx trap and NH_3-SCR catalyst are provided in a single catalytic converter shell.

[c5] 5. The emission control system of claim 4, wherein each alternating zone of the lean NOx trap and alternating zone of the NH_3-SCR catalyst have a 1" length and 1" width.

[c6] 6. The emission control system of claim 4, wherein each alternating zone of the lean NOx trap and alternating zone of the NH_3-SCR catalyst have a ½" length and a width of ½".

[c7] 7. The emission control system of claim 4, wherein each alternating zone of the lean NOx trap and alternating zone of the NH_3-SCR catalyst have a length of ¼" and a width of ¼".

[c8] 8. The emission control system of claim 1, wherein one or more alternating zones of the lean NOx trap and NH_3-SCR catalyst are provided in a single substrate.

[c9] 9. The emission control system of claim 1, wherein the lean NOx trap generates a sufficient quantity of NH_3 to force the reaction between NOx and NH_3, whereby NH_3 emissions are eliminated and net NOx conversion improved.

[c10] 10. The emission control system of claim 1, wherein the lean NOx trap is optimized for NH_3 generation by removing oxygen storage capacity of the lean NOx trap.

[c11] 11. The emission control system of claim 1, wherein the lean NOx trap comprises a precious metal selected from the group consisting of platinum, palladium, rhodium and combinations thereof; and a NOx storage material selected from the group consisting of alkali metals, alkali earth metals, rare earth metals and combinations thereof.

[c12] 12. The emission control system of claim 1, wherein the lean NOx trap comprises platinum.

[c13] 13. The emission control system of claim 1, wherein the lean NOx trap comprises a composite of cerium and zirconium.

[c14] 14. The emission control system of claim 1, wherein the lean NOx trap comprises one or more materials for NH_3 generating and NOx storage.

[c15] 15. The emission control system of claim 1, wherein the NH_3-SCR catalyst comprises one or more NH_3 adsorbing materials, wherein the NH_3 adsorbing materials are capable of converting NOx and NH_3 to nitrogen.

[c16] 16. The emission control system of claim 1, wherein the NH_3-SCR catalyst comprises a base metal and a support selected from the group consisting of alumina, silica titania, zeolite and their combinations.

[c17] 17. The emission control system of claim 1, wherein the NH_3-SCR catalyst comprises a metal selected from the group consisting of Cu, Fe and Ce and a zeolite.

[c18] 18. The emission control system of claim 1, wherein the lean NOx trap and NH_3-SCR catalyst are placed in a single catalytic converter shell.

[c19] 19. The emission control system of claim 1, wherein the NH_3-SCR catalyst is separate from and downstream from the lean NOx trap.

[c20] 20. An emission control system for controlling NOx and NH_3 emissions from an exhaust stream produced by the combination of an air/fuel mixture in an internal combustion engine, the system comprising:
a lean NOx trap in communication with the exhaust stream for NOx reduction wherein the lean NOx trap comprises a lean NOx trap formulation which includes one or more NOx storage and NH_3 generating materials;
a NH_3-SCR catalyst in communication with the exhaust stream for adsorbing NH_3, wherein the NH_3-SCR catalyst comprises a NH_3-SCR catalyst formulation which includes one or more NH_3 adsorbing materials; and
wherein the lean NOx trap formulation and the NH_3-SCR catalyst formulation are placed on one substrate.

[c21] 21. The emission control system of claim 20, wherein a layer of the lean NOx trap formulation and a layer of the NH_3-SCR catalyst formulation are placed on the substrate to form a two-layer washcoat.

[c22] 22. The emission control system of claim 20, wherein the lean NOx trap formulation and the NH_3-SCR catalyst formulation are homogeneously mixed to form a single washcoat layer on the substrate.

[c23] 23. The emission control system of claim 20, wherein the lean NOx trap formulation and the NH_3-SCR catalyst formulation are heterogeneously mixed to form a single washcoat layer on the substrate.

[c24] 24. An emission control system for controlling NOx and NH_3 emissions from an exhaust stream produced by the combination of an air/fuel mixture in an internal combustion engine, the system comprising:
a lean NOx trap in communication with the exhaust stream;
a NH_3-SCR catalyst in communication with the exhaust stream for adsorbing NH_3, wherein the NH_3 adsorbed by the NH_3-SCR catalyst reacts with NOx in the exhaust stream to improve NOx and NH_3 reduction; and
wherein the lean NOx trap and NH_3-SCR catalyst are provided in one

substrate.

[c25] 25. The emission control system of claim 24, wherein one or more alternating zones of the lean NOx trap and NH_3-SCR catalyst are provided, each zone having a 1" width.

[c26] 26. The emission control system of claim 24, wherein alternating zones of the lean NOx trap and NH_3-SCR catalyst are provided, each zone having a ½" width.

[c27] 27. The emission control system of claim 24, wherein alternating zones of the lean NOx trap and NH_3-SCR catalyst are provided, each zone having a ¼" width.

[c28] 28. The emission control system of claim 24, wherein the lean NOx trap and the NH_3 SCR catalyst are placed in one or more alternating layers in the substrate.

[c29] 29. An emission control system for controlling NOx and NH_3 emissions from an exhaust stream produced by the combination of an air/fuel mixture in an internal combustion engine, the system comprising:
a lean NOx trap in communication with the exhaust stream;
a NH_3-SCR catalyst in communication with the exhaust stream for adsorbing NH_3, wherein the NH_3 adsorbed by the NH_3-SCR catalyst reacts with NOx in the exhaust stream to improve NOx and NH_3 reduction; and
wherein the lean NOx trap and NH_3-SCR catalyst are provided in a single catalytic converter shell.

[c30] 30. An emission control system for controlling NOx and NH_3 emissions from an exhaust stream produced by the combination of an air/fuel mixture in an internal combustion engine, the system comprising:
a lean NOx trap in communication with the exhaust stream for NOx reduction, to provide a NOx reducing exhaust stream including NOx and NH_3; and
a NH_3-SCR catalyst in communication with the exhaust stream for adsorbing NH_3, wherein the NH_3 adsorbed by the NH_3-SCR catalyst reacts with NOx in the NOx reduced exhaust stream to improve the reduction of NOx and NH_3.

[c31] 31. The emission control system of claim 30, wherein the lean NOx trap generates a sufficient quantity of NH_3 to force the reaction between NOx and NH_3, whereby NH_3 emissions are eliminated and net NOx conversion improved.

[c32] 32. The emission control system of claim 30, wherein the lean NOx trap is optimized for NH_3 generation by removing oxygen storage capacity.

[c33] 33. The emission control system of claim 30, wherein the lean NOx trap comprises a precious metal selected from the group consisting of platinum, palladium, rhodium and combinations thereof; and a NOx storage material selected from the group consisting of alkali metals, alkali earth metals, rare earth metals and combinations thereof.

[c34] 34. The emission control system of claim 30, wherein the lean NOx trap comprises platinum.

[c35] 35. The emission control system of claim 30, wherein the lean NOx trap comprises a composite of cerium and zirconium.

[c36] 36. A method of controlling NOx and NH_3 emissions from an exhaust stream produced by the combination of an air-fuel mixture in an internal combustion engine, comprising:
providing a lean NOx trap in communication with the exhaust stream; and
providing an NH_3-SCR catalyst in communication with the exhaust stream for adsorbing NH_3, wherein the NH_3 adsorbed by the NH_3-SCR catalyst reacts with NOx in the exhaust stream.

[c37] 37. A catalyst system for controlling diesel particulates, comprising:
a porous substrate, including a washcoat containing lean NOx trap and NH_3-SCR catalyst formulations, wherein the porous substrate filters diesel particulates.

[c38] 38. A method of controlling diesel particulates from a diesel exhaust stream comprising:
providing a porous substrate;

incorporating a washcoat comprising lean NOx trap and NH_3-SCR formulations into the porous substrate; and

passing the diesel exhaust stream through the porous substrate to filter diesel particulates.

[c39] 39. An emission control system for controlling NOx and NH_3 emissions from an exhaust stream produced by the combination of an air/fuel mixture in an internal combustion engine, the system comprising:

a three-way catalyst in communication with the exhaust stream to reduce NOx emissions and produce NH_3, wherein the three-way catalyst comprises platinum on an outer surface of the three-way catalyst to optimize the formation of NH_3, and wherein the three-way catalyst is further optimized for NH_3 generation by removing oxygen storage capacity of the three-way catalyst; and

an NH_3-SCR catalyst in communication with the exhaust stream for adsorbing NH_3, wherein the NH_3 adsorbed by the NH_3-SCR catalyst reacts with NOx in the exhaust stream to improve the reduction of NOx and NH_3.